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FlashReports

Can bad weather improve your memory? An unobtrusive field study of natural mood effects on real-life memory ☆

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ABSTRACT

Can good or bad mood induced by the weather influence people's ability to correctly remember everyday scenes? In this unobtrusive field study, we predicted and found that weather-induced negative mood improved memory accuracy. Randomly selected shoppers on bright, sunny days (good mood) or on cloudy, rainy days (bad mood) saw 10 unusual objects in the check-out area of a suburban shop, and their recall and recognition memory for these objects was later tested. Shoppers in a negative mood showed better memory and higher discrimination ability. The cognitive mechanisms responsible for everyday mood effects on memory performance are discussed, and the implications of these findings for current affect/cognition theories and applied areas are considered.

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Can the weather influence how well people remember objects they see while walking around in a shop? Accurately remembering mundane, everyday scenes is a difficult and demanding task, yet such memories can be of crucial importance in everyday life, as well as in forensic and legal practice (Loftus, 1979; Neisser, 1982). Surprisingly, the influence of mood states on the accuracy of real-life memories is still poorly understood. This study investigated the possibility that negative affect induced by inclement weather can improve memory for causally observed scenes and objects (Bless & Fiedler, 2006; Fiedler, Asbeck, & Nickel, 1991; Forgas, 2002).

Remembering the details of everyday scenes is a fragile process that is often influenced by what people pay attention to, as well as contamination by subsequent incorrect information (Fiedler et al., 1991; Loftus, 1979; Wells & Loftus, 2003). For example, misleading information after the event can produce a false memory later on, the so-called misinformation effect (Loftus, 1979; Schooler & Loftus, 1993). Surprisingly, negative mood reduces people's susceptibility to the misinformation effect and produces more accurate eyewitness memories (Forgas, Laham, & Vargas, 2005), by promoting a more careful and accommodative thinking strategy (Fiedler et al., 1991). This study will extend this work by examining

the effects of naturally occurring mood on memory for real-life scenes.

Affect and memory

Although the influence of affect on thinking and behavior has long been recognized, mood effects on real-life memory received relatively little attention (cf. Eich & Schooler, 2000; Forgas et al., 2005; Neisser, 1982; Schooler & Eich, 2000). Affective states can exert an *informational* influence on what people remember, selectively priming affect-congruent information, and information encountered in a matching mood (Bower, 1981; Bower & Forgas, 2001; Eich & Macauley, 2000; Fiedler, 2001; Forgas, 1995, 2002). Such mood-congruence in memory can even influence the way people think about their intimate romantic relationships (Forgas, 1995).

More interestingly, moods can also exert a significant *processing* effect on *how* people deal with social information. Early theories assumed that positive mood leads to less effortful processing (Clark & Isen, 1982; Sinclair & Mark, 1992), while negative mood promotes effortful and vigilant processing (Schwarz, 1990; Schwarz & Bless, 1991). Explanations of this effect at first emphasized either (a) *functional principles* suggesting that affective states signal the degree of effort and vigilance required in more or less demanding situations, or (b) *motivational principles*, as happy people may seek to preserve their good mood by avoiding cognitive effort (mood maintenance), and dysphoric individuals increase cognitive effort to improve their mood (mood repair) (Clark & Isen, 1982).

A more recent and comprehensive explanation for these processing effects by Bless and Fiedler (2006) suggests that rather

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than influencing processing effort, different moods have an evolutionary function recruiting qualitatively different processing styles. Negative moods call for *accommodative, bottom-up* processing, focused on the details of the external world. In contrast, positive moods recruit *assimilative, top-down* processing and greater reliance on existing schematic knowledge and heuristics (Bless, 2000; Fiedler, 2001). Several studies now support this processing dichotomy. For example, Fiedler et al. (1991) found that priming effects were reduced by negative mood. Further, negative affect, by facilitating the processing of new external information, can also reduce judgmental mistakes such as the fundamental attribution error (Forgas, 1998), improve the quality and efficacy of persuasive arguments (Forgas, 2007), and also improve eyewitness memory (Fiedler et al., 1991; Forgas et al., 2005).

Aims and predictions

Extrapolating from these results, thus, this paper aims to explore the influence on naturally occurring happy and sad moods induced by the weather on the accuracy of remembering scenes in a real-life setting. We expect that people in a negative mood should engage in more attentive and accommodative processing, and should remember incidentally encountered details in a shop better. In contrast, a more top-down, assimilative processing style associated with positive affect should reduce the extent to which incidentally observed objects are encoded and remembered.

Method

Overview, mood induction, and participants

This unobtrusive study was carried out in a suburban newsagency/stationery shop in Sydney, Australia, where the cooperation of the owners was obtained. The study was carried out on 14 different days over a 2-month period, at the same times of the day (11 am to 4 pm) and using the same check-out clerk in order to control for possible confounding factors such as shop crowding, the clerk's personality and behavior, and other random situational variables. Mood was manipulated by (a) carrying out the study on rainy, cloudy days (negative mood), or on sunny, bright days (positive mood), and these moods were reinforced by (b) playing happy, or sad music in the shop. Weather has been a reliable and effective inducer of moods in prior research (e.g., Schwarz & Clore, 1988). The target objects to be remembered were 10 small domestic decorative objects that were randomly displayed on and around the check-out counter. Participants were 73 randomly selected shoppers (32 females, 41 males) who entered the shop on 14 different rainy or sunny days, spent on average about five minutes in the shop, and made a purchase that required them to spend time at the check-out counter. After leaving the shop, a research assistant asked participants to complete a brief questionnaire assessing their cued recall and recognition memory for the target objects. Supplementary analyses (see Discussion, below) confirmed that people in the two mood conditions spent equal amounts of time in the shop and at the check-out counter, confirming that 'lingering' and longer exposure on rainy days was not the cause of any observed differences.

Target items, dependent measure and procedure

Ten small ornamental objects were randomly displayed on the check-out counter, and included four different kinds of plastic animal figures, a toy canon, a pink savings pig, and four small matchbox vehicles (a red London bus, a tractor, etc.). Cued recall memory for the ornaments was assessed by a research assistant asking par-

ticipants after leaving the shop to 'remember and list as many of the small ornamental objects that were located on the counter of the news agency as you can remember'. The recognition test featured a list of 20 items, 10 of which were targets, and 10 were not seen before (foils). Participants rated on 6-point scales whether they did, or did not recognize seeing each item. Finally mood differences were validated, asking participants to indicate how they felt on two nine point scales (happy-sad; good-bad).

Results

Mood validation

Mood ratings on the good-bad and happy-sad scales were highly correlated (Cronbach's $\alpha = .888$) and were combined into a single measure of mood valence. Results confirmed the predicted mood differences: people in the positive mood condition reported significantly better mood ($M = 2.61$, $SD = 1.44$) than did people in the bad mood condition ($M = 0.54$, $SD = 1.38$), $t(70) = 6.68$, $p < .001$, $d = 1.60$.

Recall memory

The number of correctly and incorrectly recalled items was entered into a 2 (mood: happy vs. sad) \times 2 (recall: correct vs. incorrect) mixed ANOVA. There was a significant mood main effect, $F(1,70) = 28.76$, $p < .001$, $d = 1.28$, as negative mood participants overall listed three times more items ($M = 3.14$, $SD = 1.91$) than positive mood participants ($M = 1.03$, $SD = 1.38$; see Fig. 1). More importantly, there was a strong interaction between mood and correctly/incorrectly recalled items, $F(1,70) = 17.42$, $p < .001$, $d = 1.00$. As expected, negative mood participants recalled more items correctly than incorrectly (difference: $M = 1.14$, $SD = 1.76$), while this pattern was completely reversed for participants in a positive mood (difference: $M = -0.42$, $SD = 1.38$).

Recognition

Recognition ratings of the 10 original items and 10 foils on 6-point recognize/do not recognize scales were averaged for correctly (hits) and incorrectly recognized items (false alarms). A 2 (mood: happy vs. sad) \times 2 (recall: correct vs. incorrect) mixed ANOVA showed a mood main effect as negative mood participants recognized more items ($M = 1.98$, $SD = 1.14$) than participants in a positive mood ($M = 0.64$, $SD = 1.18$), $F(1,70) = 23.82$, $p < .001$, $d = 1.17$. Negative mood participants also correctly recognized

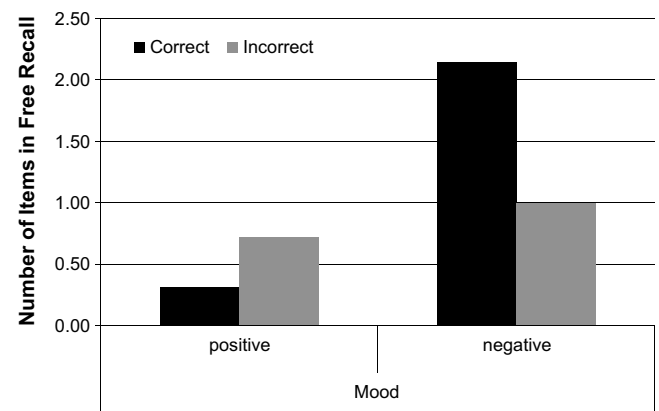


Fig. 1. The effects of positive and negative mood on the number of correctly and incorrectly remembered items on the cued recall measure.

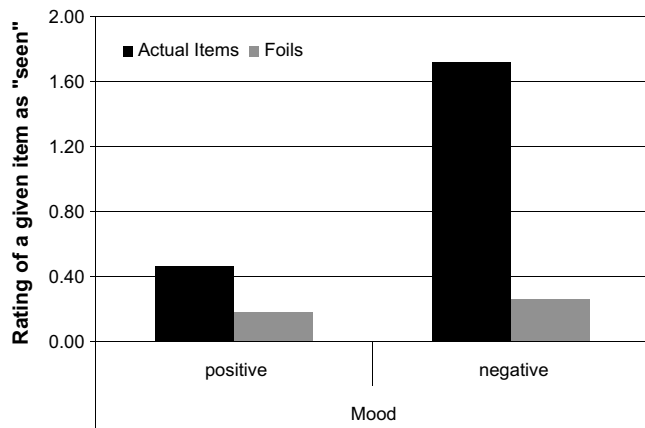


Fig. 2. The effects of positive and negative mood on the number of correctly (hits) and incorrectly (false alarms) recognized items.

more items ($M = 1.46$, $SD = 0.86$) than positive mood participants ($M = 0.28$, $SD = 0.44$), $F(1, 70) = 53.47$, $p < .001$, $d = 1.75$ (Fig. 2).

Signal detection analysis

Hits and false alarms were defined as any response over three, recognizing a target item (hit) or a foil (false alarm). Due to small number of trials, we used the non-parametric measure of discrimination ability A' , where a value of 0.5 indicates no discrimination and a value of 1.0 indicates perfect discrimination (Stanislaw & Todorov, 1999). Results confirmed a significant mood effect. Participants in a negative mood showed significantly higher discrimination ability ($A' = .741$, $SD = .145$) than positive mood participants ($A' = .577$, $SD = .153$), $t(70) = 4.66$, $p < .001$, $d = 1.11$. Further, participants in both conditions showed discrimination ability significantly better than the 0.5 chance level ($t(35) = 3.03$, $p < .01$ and $t(35) = 9.99$, $p < .001$, for positive and negative mood, respectively), suggesting that they had actual memory for what they had seen.

Discussion

Despite growing interest in affect and cognition in recent years (Bless & Fiedler, 2006; Bower & Forgas, 2001; Eich & Macauley, 2000; Forgas, 2002), the influence of natural moods on real-life memory has received less than adequate attention. This study is the first to show in a real-life setting that weather-induced mood can have a significant influence on people's ability to remember casually observed scenes. As predicted, the benefits of negative mood for recall accuracy are consistent with recent affect-cognition theories (Bless & Fiedler, 2006). These findings have several interesting theoretical, as well as practical implications.

Theoretical implications

Although numerous studies demonstrated mood-state-dependence and mood-congruity in memory (Bower, 1981; Bower & Forgas, 2001; Eich & Macauley, 2000), the processing effects of mood on real-life memory have received little attention. These results support recent affect-cognition theories that predict that good and bad moods should selectively promote *assimilative* and *accommodative* thinking styles (Bless & Fiedler, 2006; Fiedler, 2001; Forgas, 2002). The findings are also conceptually consistent with laboratory experiments showing that negative mood seems to reduce priming effects (Fiedler et al., 1991), produce more accurate social judgments and inferences (Bless & Fiedler, 2006; Fiedler et al., 1991), reduce judgmental biases such as the fundamental attribution error (Forgas, 1998), and improve the quality and effi-

cacy of persuasive arguments (Forgas, 2007). The present study extends these findings to memory in a real-life setting.

Although we were unable to collect direct processing measures in a field setting, past experiments show that processing latency is indeed an important mediator of mood effects (Bower & Forgas, 2001; Forgas, 1995; Sedikides, 1995). Given the conceptual consistency of our results with prior laboratory work, the results seem most consistent with theories that predict that negative mood promotes an accommodating, externally focused processing style increasing sad people's tendency to attend to and carefully encode observed information (Bless, 2000; Bless & Fiedler, 2006). The observed results are specifically consistent with Fiedler et al.'s (1991) dual-force model and their prescient suggestion that "good mood can be predicted to produce more false alarms in eyewitness reports" (p. 376), exactly the result we obtained here.

Given the limits of a field study, we could not separate encoding and retrieval effects, an issue that certainly deserves attention in future studies. It seems that the memory trace for these incidentally observed objects was rather weak, as it is probably the case in real life as well (Fig. 1). It may well be that stronger memory traces may be less influenced by incidental mood effects (Pezdek & Roe, 1995; Reyna & Lloyd, 1997), an issue that also deserves further investigation.

Practical implications

Accurately remembering everyday scenes is an important skill. Such recollections are especially important in legal, judicial and in forensic settings. Despite strong recent evidence for affective influences on cognitive processes (Clore, Gasper, & Garvin, 2001; Fiedler et al., 1991; Forgas, 2002; Sedikides, 1995), this is the first study that demonstrated the memory benefits of negative mood in a real-life environment. This finding suggests that some allowance for such mood effects could be incorporated in applied domains such as legal, forensic, counselling and clinical practice. However, as these mood induced processing effects appear largely subconscious and unintended, people may have little meta-cognitive awareness or indeed, control over mood effects on their thinking (Forgas et al., 2005; Nisbett & Wilson, 1977). Despite disproportionate emphasis on the beneficial consequences of positive mood in recent applied psychology, our findings add to the growing number of studies showing that negative moods can produce a variety of cognitive benefits in real-life situations (Forgas, 1998, 2002).

Limitations and future prospects

There are some obvious limitations to these results. Past evidence suggests that mood effects on cognition are quite subtle (Forgas, 1995, 2002). In circumstances that call for more motivated processing (for example, due to the personal relevance of the task; Forgas, 2002) mood effects may be reduced. Situational variables such the nature and salience of the target information, the intensity of the affective state, and the time elapsed between encoding and retrieval may also mediate these effects. There is much scope in future studies to explore the role of pragmatic variables in recruiting different processing strategies, and thus mediating the ensuing mood effects on memory.

Could these effects be due to the fact that in bad weather, people spent more time in the shop and observed the objects better? To check this possibility, we carried out a supplementary study ($N = 50$) where over several sunny and rainy days, we surreptitiously recorded the time shoppers spent in the shop, and the time they spent in front of the check-out counter. Results confirmed that the total time spent in the shop was the same on rainy and sunny days ($M = 319.36$ vs. 346.04 s); $t(48) = -.782$, *NS*. There was also no difference in the time spent in front of the check-out counter ($M = 64.60$

vs. 60.68 s), $t(48) = .579$, NS, confirming that differential exposure cannot be an alternative explanation of our findings. Further, as the study was carried out on 14 different days at the same time of day over a 2-month period using the same check-out staff, uncontrolled daily variations are also unlikely to have influenced our results. Given the realistic unobtrusive methods we used, these findings are likely to be reliable and have considerable external validity.

Remembering personally witnessed scenes is a demanding task (Loftus, 1979). The result that negative mood increases, and positive mood decreases memory accuracy extends our knowledge of how real-life memory processes operate (Bower, 1981; Clore et al., 2001; Fiedler, 2001; Forgas, 1995; Neisser, 1982), and confirm the important role that information processing strategies play in mediating mood effects on thinking and memory (Forgas, 2002). Further research on natural affect and real-life memory should be of considerable theoretical, as well as applied interest.

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